ing to it; but the analogies which connect aluminium with other metals are so close and so numerous, that there are probably few metals of which the position in our classification is more satisfactorily settled. We may safely trust that the able investigators who are examining these interesting compounds will bring them more fully than now within the laws which regulate the combining proportions of their constituent elements; for, as it now stands, the anomaly is far less than many others which have been satisfactorily explained by further investigations.

Meanwhile aluminium is a metal singular for only appearing in that pseudo-triatomic character in which iron and chromium appear in their sesquisalts.

February 16, 1865.

Dr. W. A. MILLER, Treasurer and Vice-President, in the Chair.

The following communications were read:—

I. "On the Synthesis of Tribasic Acids." By MAXWELL SIMPSON, M.D., F.R.S. Received January 25, 1865.

(Abstract.)

In a former Number of the 'Proceedings'* I gave a preliminary notice of a tribasic acid having the composition $C_{12} H_8 O_{12}$, formed by the action of potash on tercyanide of allyle. The process for the preparation of the acid given in that paper I have since succeeded in improving very considerably, so that I can now obtain it in quantity and with tolerable facility. An account of the improved process is contained in the general paper which accompanies this abstract. The paper also contains a description of the crystalline form of the acid, for which I am indebted to Professor Miller of Cambridge.

M. Kekulé† proposes to call this body carballylic acid. This name I cannot, however, accept without some modification, as recent researches‡ have proved that it belongs by right to crotonic acid. I propose therefore, in order to avoid confusion, to call it *tri*carballylic acid.

Since the appearance of my preliminary paper, I have also prepared and analyzed several of the salts and ethers of this acid, of which the following is a short account.

Tricarballylic Ether, $\left.\begin{matrix} C_{12} H_5 O_6{}''' \\ (C_4 H_5)_3 \end{matrix}\right\} O_6$.

This ether is readily prepared by conducting a stream of dry hydrochloric acid gas into a solution of tricarballylic acid in absolute alcohol. The product obtained on evaporating the alcohol distils between 295° and 305° C.

* Proceedings of the Royal Society, vol. xii. p. 236.

† Lehrbuch der Organischen Chemie, vol. ii. p. 187.

‡ Annalen der Chemie und Pharmacie, vol. cxxxi. p. 58.

It is a colourless liquid, is slightly soluble in water, and has an acrid taste. Heated with solid potash it suffers decomposition, alcohol being formed and the acid regenerated.

Tricarballylic Amylic Ether, $\left.\begin{array}{l}C_{12}H_5O_6{}'''\\(C_{10}H_{11})_3\end{array}\right\}O_6.$

This body is formed when dry hydrochloric acid gas is passed into a mixture of one part by weight of tricarballylic acid and two parts of pure amylic alcohol maintained at the temperature of boiling water. The product may be partially purified by heating it in a retort till 200° C., and then dissolving it successively in alcohol and in ether. It is a thick oily liquid, is heavier than water, and has an acrid taste. Its boiling-point is beyond the range of the mercurial thermometer. Heated with solid potash, it is resolved into amylic alcohol and tricarballylic acid.

Glyceri-tricarballylate of Baryta, $\left.\begin{array}{l}C_{12}H_5O_6{}'''\\C_6H_7O_4{}'\\Ba_2\end{array}\right\}O_6.$

This salt was prepared by maintaining for several hours at the temperature of 200° C. in a sealed tube a mixture of one part of tricarballylic acid and two parts of pure glycerine. The product was neutralized by a solution of baryta, evaporated to dryness, and digested with absolute alcohol to remove the uncombined glycerine. A buff-coloured powder was thus obtained having, I have no doubt, the composition expressed by the above formula, although my analyses do not correspond very well with it. The acid combined with the baryta is bibasic, and is represented by the formula

$$\left.\begin{array}{l}C_{12}H_5O_6{}'\\C_6H_7O_4{}'\\H_2\end{array}\right\}O_6.$$

Soda-salts of Tricarballylic Acid.

The soda-salts of this acid are very soluble in water and difficult to crystallize. Three salts may, I believe, be found, containing respectively one, two, and three equivalents of sodium. One equivalent of the acid I found required for complete neutralization exactly three equivalents of pure carbonate of soda. The composition of the salt with two equivalents of sodium which I obtained in crystals is probably $\left.\begin{array}{l}C_{12}H_5O_6{}'''\\Na_2\\H\end{array}\right\}O_6+4HO.$

Tricarballylate of Lime, $\left.\begin{array}{l}C_{12}H_5O_6{}'''\\Ca_3\end{array}\right\}O_6+4HO.$

When a solution of this acid is neutralized with lime-water and evaporated, a white amorphous powder separates, which is the salt in question. It is sparingly soluble in water, and freely soluble in dilute acids.

Tricarballylate of Copper, $\left.\begin{array}{l}C_{12}H_5O_6{}'''\\Cu_3\end{array}\right\}O_6.$

This salt falls in the form of a beautiful bluish-green powder when sul-

phate of copper is added to a hot solution of tricarballylate of soda. It is insoluble in water, but soluble in dilute acids.

Tricarballylate of Lead, $\left.\begin{matrix} C_{12}\,H_5\,O_6{}''' \\ Pb_3 \end{matrix}\right\} O_6$.

This salt precipitates when an excess of acetate of lead is added to a solution of tricarballylate of soda. It is a white powder insoluble in water, but soluble in dilute nitric acid.

The composition of the foregoing salts and ethers fully confirms the view I took of the basicity of this acid in my preliminary paper. It is, I believe, at present the sole representative of its class. It will not, however, I believe, long remain so, as the process by which it has been obtained will, I have no doubt, be found to be of general application.

This acid bears the same relation to citric acid that succinic bears to malic acid :—

$C_{12}\,H_8\,O_{12}$, tricarballylic acid.	$C_8\,H_6\,O_8$, succinic acid.
$C_{12}\,H_8\,O_{14}$, citric acid.	$C_8\,H_6\,O_{10}$, malic acid.

That this relationship exists not only on paper, but also in the nature of the bodies themselves, is, I think, highly probable. In order to arrive at certainty on this point, I have endeavoured, by the addition of two equivalents of oxygen, to transform tricarballylic into citric acid. My researches in this direction have not hitherto been attended with success.

II. "Notes of Researches on the Acids of the Lactic Series.—No. III. Action of Zincethyl upon Ethylic Leucate." By E. Frankland, F.R.S., and B. F. Duppa, Esq. Received February 1, 1865.

In describing the production of ethylic leucate or diethoxalate*, formed when zincethyl acts upon ethylic oxalate, we assumed the intermediate formation of zincoleucic ether, and explained the reaction by the following equation, in which zinc is regarded as a monatomic metal :—

$$\underset{\text{Ethylic oxalate.}}{C_2\left\{\begin{matrix} O \\ O\,C_2\,H_5 \\ O \\ O\,C_2\,H_5 \end{matrix}\right.} + \underset{\text{Zincethyl.}}{Zn'_2\left\{\begin{matrix} C_2\,H_5 \\ C_2\,H_5 \end{matrix}\right.} = \underset{\text{Zincoleucic ether.}}{C_2\left\{\begin{matrix} (C_2\,H_5)_2 \\ OZn' \\ O \\ O\,C_2\,H_5 \end{matrix}\right.} + \underset{\text{Zincethylate.}}{\left.\begin{matrix} Zn' \\ C_2\,H_5 \end{matrix}\right\} O}.$$

In contact with water we conceived zincoleucic ether to be decomposed with the formation of ethylic leucate and zinc hydrate,

$$\underset{\text{Zincoleucic ether.}}{C_2\left\{\begin{matrix} (C_2\,H_5)_2 \\ OZn' \\ O \\ O\,C_2\,H_5 \end{matrix}\right.} + H_2\,O = \underset{\text{Ethylic leucate.}}{C_2\left\{\begin{matrix} (C_2\,H_5)_2 \\ OH \\ O \\ O\,C_2\,H_5 \end{matrix}\right.} + \left.\begin{matrix} Zn' \\ H \end{matrix}\right\} O.$$

Since these reactions were thus expressed, zinc has come to be generally

* Proceedings of the Royal Society, vol. xii. p. 396.